

# Collaborative Decision Making Process: A flexible, preferences based, methodology

Pascale Zaraté, Christophe Sibertin-Blanc  
IRIT – Toulouse Capitole University  
{zarate,sibertin}@irit.fr

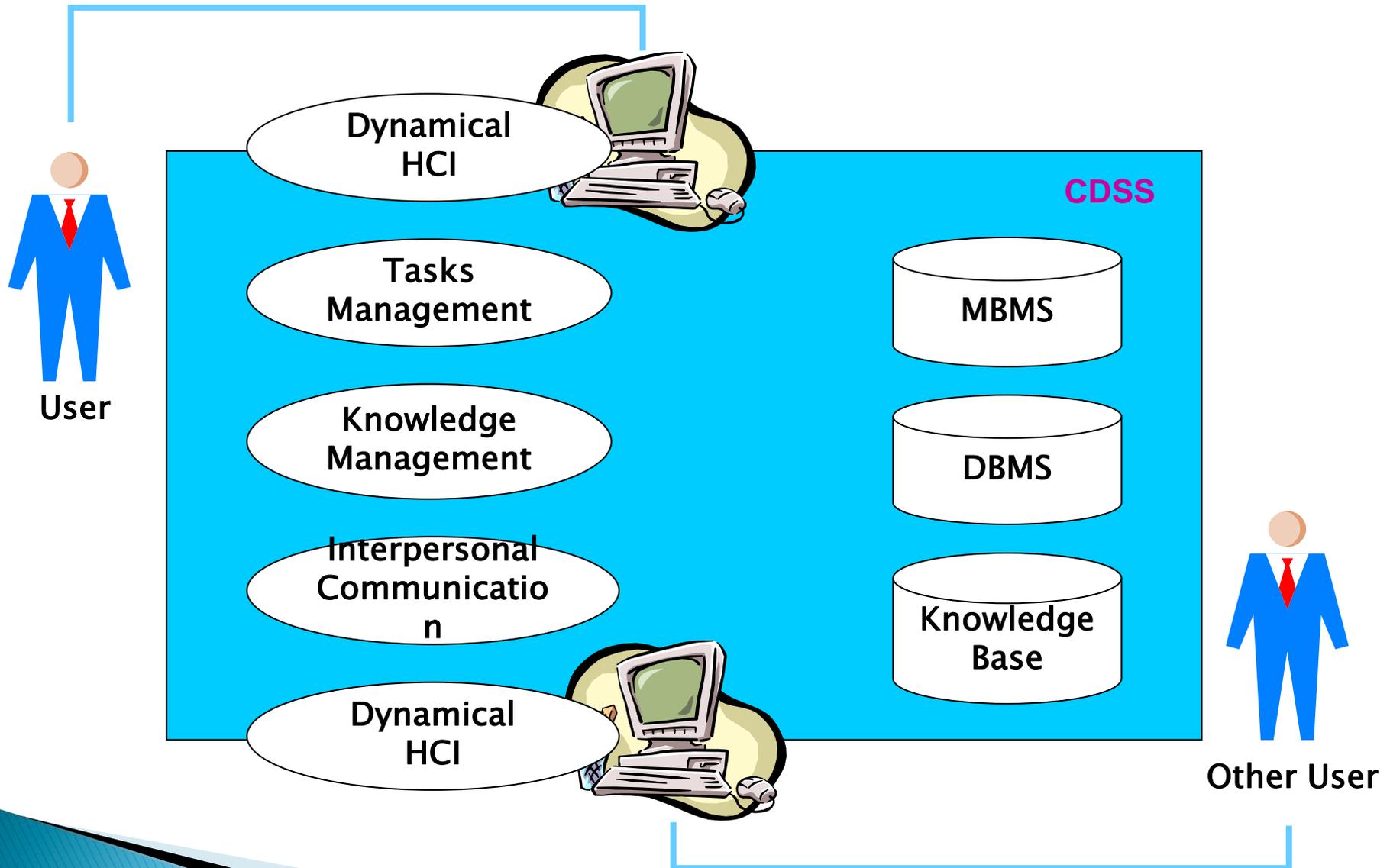
# Content

- ▶ Collaborative Decision
- ▶ Tools for Collaborative Decision
- ▶ Group Support Systems & Facilitation Process
- ▶ MCDM Group Decision Making
- ▶ Methodology to support Co-Decision Processes
- ▶ GRUS System
- ▶ Conclusion

# ICT Introduction in Organizations

- ▶ ICT : Decision Making processes modification
  - Organizational : Multi-actors
  - Cognitive : Sorting Step reinforcement
- ▶ Collaborative Decision
  - Process orientation
  - Electronic Teams
  - Asynchronous / Distributed Processes
- ▶ Needs to design new tools : Collaborative Decision Support Systems

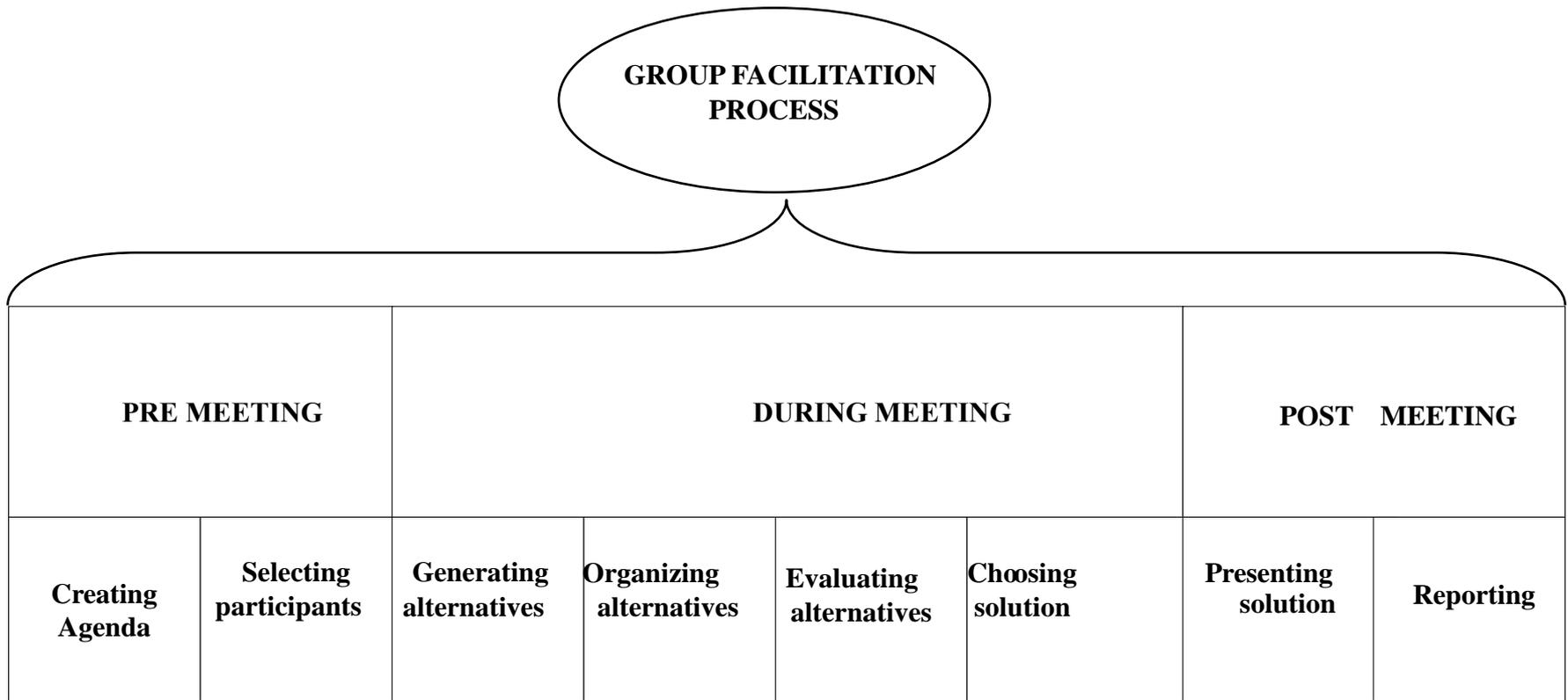
# Cooperative DSS



# Group Support Systems

- ▶ Improve quality of Decision Processes
- ▶ Facilitation is needed particularly in Asynchronous / Distributed situations
- ▶ Facilitation Process (Adla, 2010)
  - Difficulties to agree on common criteria of Decision Making

# Facilitation Process



**Fig. 1:** Group facilitation process

# MCDM Group Decision Making

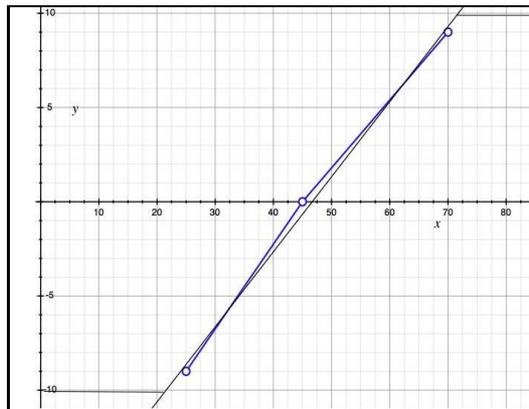
- ▶ Macharis et al. (1998)
  - GDSS: Promethee
  - Decision Makers
    - Individual Preferences → One performance matrix by Decision Maker
    - Same or Different Weight for each criteria
  - Global aggregation for the group → Weighted Sum
- ▶ Advantage: Sensitive Analysis among Stakeholders
- ▶ Limit: No Collaboration, No Co-Decision

# Proposed Methodology

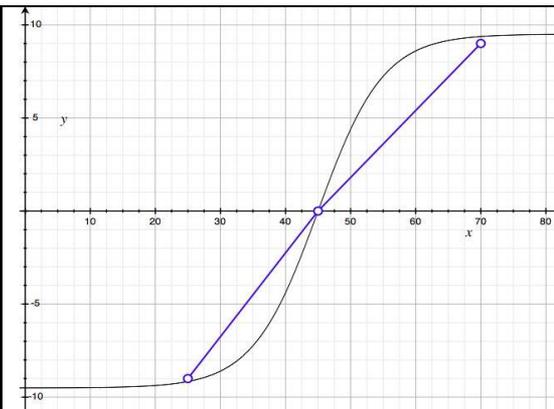
- ▶ Sharing information for Co-decision Processes
- ▶ 2 levels of preferences
  - Common Criteria discussed among the stakeholders
  - Individual Criteria

# Criteria

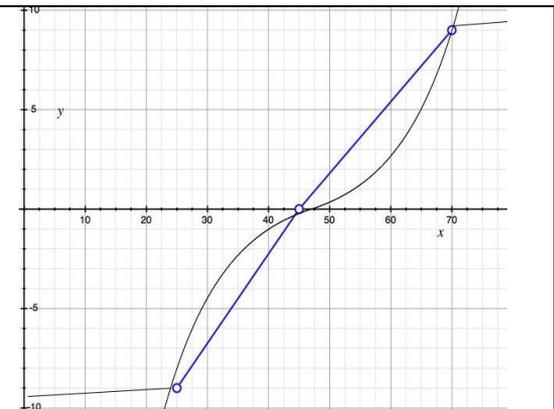
- ▶ Suitability Function
  - Scoring Scale
  - Indifference Score
  - Reject Score
  - Shape of Interpolation



(a) linear improvement of the suitability



(b) sigmoide improvement of the suitability



(c) plateau improvement of the suitability

# Methodology

## ▶ Step 1: Collective Evaluation

### Agreement on

- Collective Criteria Definition
- Scoring scale
- Score of each alternatives for these common criteria
- Weight of each participant
- Which level of sharing information
- How many iterations

# Methodology

- ▶ Step 2: Individual evaluation
  - Individual Criteria → private no shown
  - Personal Weights for all criteria
  - Personal Suitability Functions for all determinant criteria
  - Dependences of all criteria

# Methodology

## ▶ Step 3: Aggregation and Analysis

### System computes

- Global Weight → Sum of all weights (individual and collective)
- Statistics: Average and Standard deviation of weight of collective criteria
- Statistics of Suitability Function for Collective Criteria → Average, Standard Deviation, Min, Max
- Collective Assessment of each alternatives (median, standard deviation and extremum values )
- Sensitivity Analysis

# Methodology

- ▶ Step 4: Discussion
  - Allow participants to see all data
  - Discussion fed by the results computed by the system
  - Justification of some preferences
  - Come back to step 2 if necessary

# GRoUp System (GRUS)

» Web Application : ToolBox



» Based on Grails web application framework

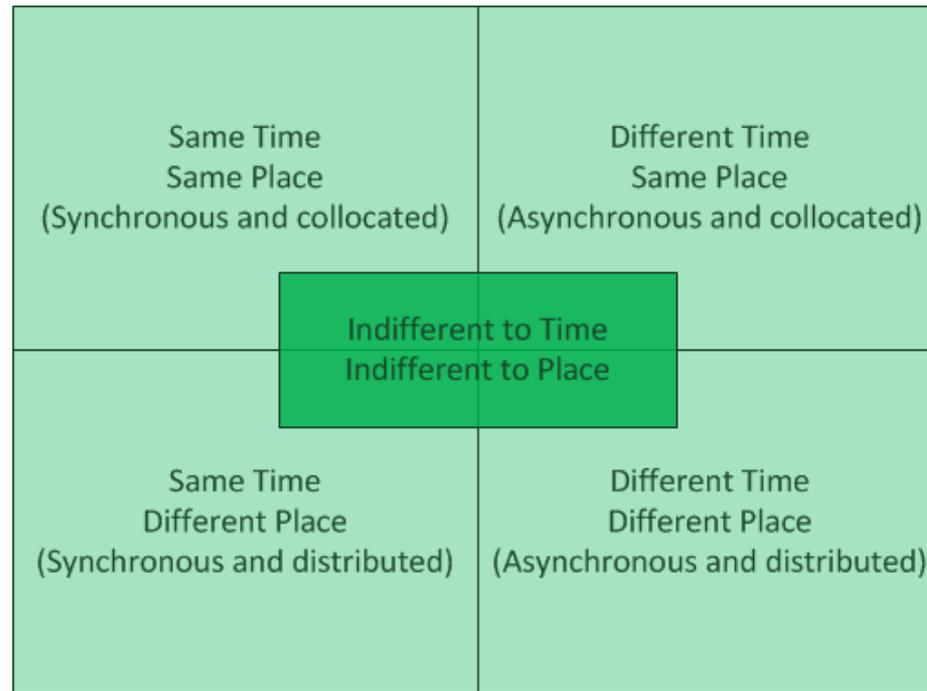
> Open Source Framework



» GRUS is a fully open source system :  
available upon request

# GRUS Features 1 / 2

» Can be used in several situations



» In GDSS, 2 roles of user

- > One facilitator (meeting manager)
- > Several Participants (meeting contributors)

# GRUS Features 2/2

- » 2 kinds of meetings are available
  - > Public meetings
    - + All registered users in GRUS system can participate
  - > Private meetings
    - + Only invited users can participate to a private meeting
  
- » Some collaborative tools are available
  - > Electronic Brainstorming
  - > Categorizer
  - > Vote
  - > Agenda
  - > Report...
  
- » User with the role of facilitator can for her/his meeting
  - > Define the meeting type
    - + Group process (sequence of collaborative tools)
  - > Invite users
  - > Manage the group process (stop, add, delete,...) tools

# GRUS Objectives

- » Open System for
  - > Sharing collaborative tools
  - > Sharing group processes



- » Promote the use of GDSS in organizations

- » Improve the efficiency of group work

# GRUS

- » MCDA aggregation tools :
  - > Weighted Sum / Choquet
  - > Other technics : to be implemented
  
- » MCDA aggregation tools use :
  - > Definition of alternatives (=ideas)
  - > Definition of criteria : public or private
  - > Definition of suitability functions
  - > Definition of performances
  
- » Weight of participants :
  - > Equi-weighted
  - > Could be parametrizable

# GRUS : Creation of a New Process

Logo and Project Name

Options ▾ rafik ↗

Home

Open meeting

Support

Developer

Plugin

About

 Meeting list

 Process List

 New Meeting

## Create Process

Title \*

Choose your tools

brainstormingWs  
clustering  
consensus  
vote

>

<

brainstorming  
vote



Filter

 Create

# GRUS : Process Modification

Logo and Project Name

Options - rafik



Click to update the current process



Topic : My topic to discuss

Edit meeting

Edit your current process : My 1st process:My topic to discuss

brainstorming

vote

clustering

consensus

← Add tool

Remove last tool

Save changes

- brainstorming
- brainstormingWs
- clustering
- consensus
- vote

# Collective Preferences



Topic : Selection of PhD Student

Vote

Please introduce performances for each alternative

Alternatives	Age	Cursus	Publications
John	<input type="text" value="18"/>	<input type="text" value="18"/>	<input type="text" value="15"/>
John	<input type="text" value="14"/>	<input type="text" value="10"/>	<input type="text" value="18"/>
Helena	<input type="text" value="14"/>	<input type="text" value="13"/>	<input type="text" value="10"/>

Objectif(s) : We have to choose one candidate among three for a PhD Position

Example : PhD Student selection

# Individual Preferences

## Weight and preference function

Please introduce the weight and the parameters for the preference function for each criterion.

Criterion	Mark	Minimum	Desired	Maximum
Age	<input type="text" value="12"/>	<input type="text" value="1"/>	<input type="text" value="20"/>	<input type="text"/>
Cursus	<input type="text" value="- Please vote"/>	<input type="text" value="- Minimum performan"/>	<input type="text" value="- Desired performanc"/>	<input type="text"/>
Publications	<input type="text" value="- Please vote"/>	<input type="text" value="- Minimum performan"/>	<input type="text" value="- Desired performanc"/>	<input type="text"/>

Example : PhD Student selection

# Individual Preferences

## Dependency between criteria

Please introduce the dependency between the criteria

Criterion	Age	Cursus	Publications
Age	<input type="text"/>	<input type="text" value="6"/>	<input type="text" value="12"/>
Cursus	<input type="text"/>	<input type="text"/>	<input type="text" value="14"/>
Publications	<input type="text"/>	<input type="text"/>	<input type="text"/>

Objectif(s) : We have to choose one candidate among three for a PhD Position

Example : PhD Student selection

# Criteria Aggregation

Topic : Selection of PhD Student

Consensus

Criterion	Average	Standard deviation	Minimum	Desired	Maximum	Authorized minimal performance	Authorized maximal performance
	Summary of the weights attributed by the decision-makers		Global preference			Tolerated minimal and maximal performances	
Age	12	0	1	20	20	1	20

Objecti  
choose  
among  
Position

---> The importance of the criterion --Age-- in the model:1.198

Example : PhD Student selection

# Final Ranking

## Summary of the mark for the alternatives

- **Results of the alternative--John --**

---> Global mark obtained by integral of Choquet: 1.44

---> Global mark obtained by balanced sum: 1.8

- **Results of the alternative--John --**

---> Global mark obtained by integral of Choquet: 1.26

---> Global mark obtained by balanced sum: 1.8

- **Results of the alternative--Helena --**

---> Global mark obtained by integral of Choquet: 0.9

---> Global mark obtained by balanced sum: 1.5

Objectif  
chose  
among  
Position

# Conclusion

- ▶ Proposed methodology for Co-Decision
  - Co-construction of the Decisional Process
  - Process oriented
- ▶ GDSS Platform under development: to be improved
- ▶ Aggregation technic simple (weighted sum)
  - ➔ Limit: to be improved

# Perspectives

- ▶ Methodology allows a participatory decision making process including 2 levels of preferences
  - Individual: Citizen could be involved in the Individual preferences evaluation
  - Collective: Citizen could be involved in the decision making process and problem definition
- ▶ Remark: Finite set of stakeholders

# References

- ▶ 1. Gorry G., Scott Morton M.: A framework for management information systems. Sloan Management Review, Vol 13, N° 1, pp. 50–70 (1971)
- ▶ 2. Smoliar S., Sprague R.: Communication and Understanding for Decision Support. Proceedings of the International Conference IFIP TC8/WG8.3, Cork, Ireland, pp. 107–119 (2002)
- ▶ 3. Zaraté P.: Tools for Collaborative Decision–Making. John Wiley (2013)
- ▶ 4. Adla A., Zaraté P., Soubie J.L.: A Proposal of Toolkit for GDSS Facilitators. Group Decision and Negotiation, Springer, Vol. 20, N° 1, pp. 57–77 (2011)
- ▶ 5. Schmidt K. and Bannon L.: Taking CSCW Seriously : Supporting Articulation Work. Computer Supported Cooperative Work (CSCW), Vol 1, N° 1 (1992)
- ▶ 6. de Terssac G., Maggi B.: Autonomie et Conception. In de Terssac G. et Friedberg E. (Eds) Coopération et Conception. Octaves Edition, ISBN : 2–906769–33–9 (1996)
- ▶ 7. Nunamaker J., Briggs R.O., Mittleman D., Vogel D., Balthazard P.: Lessons from a dozen years of group support systems research: a discussion of lab and field findings. Journal of Management Information Systems, Vol. 13, N° 3, pp. 163–207 (1997)
- ▶ 8. Macharis C., Brans J.P., Maréchal B.: The GDSS PROMETHEE Procedure. Journal of Decision Systems, Vol. 7 –SI, pp. 283–307 (1998)
- ▶ 9. Soner Kara, S., Cheikhrouhou, N.: A multi criteria group decisions making approach for collaborative selection problem. Journal of Intelligent and Fuzzy Systems 26 (1), IOS Press (2014)
- ▶ 10. Slovic P., Finucane M., Peters E., MacGregor D.G.: The affect heuristic, in: T. Gilovitch, D. Griffin, D. Kahneman (Eds.), Heuristics and Biases: The Psychology of Intuitive Judgment, Cambridge University Press, Cambridge, pp. 397–420 (2002)
- ▶ 11. Labreuche, C., Grabisch, M. : Generalized Choquet–like aggregation functions for handling bipolar scales, European Journal of Operational Research 172, pp. 931–955 (2006)
- ▶ 12. Sibertin–Blanc C., Zaraté P.: A flexible Multi–Criteria Methodology for Collective Decision Making Preferences. Group Decision and Negotiation Journal, to appear